ANNUAL REPORT FOR 1933

Northern Rocky Mountain Forest and Range Experiment Station
Missoula, Montana

/R
Investigative Program
Northern Rocky Mountain Region

June 19, 1934.

REGION ONE INVESTIGATIVE COUNCIL

ANNUAL REPORT FOR 1933

and

PROGRAM FOR FISCAL YEAR 1935

For the Investigative Council

~~[illegible]~~ Chairman out

1s1 Lyle F. Watts
Secretary

Approved June 19, 1934.

1s1 Frank J. Jefferson
acting Regional Forester

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INVESTIGATIVE COUNCIL

The annual meeting of the Regional Investigative Council for the Northern Rocky Mountain Region was held at the University of Montana, Missoula, Montana, on March 1 and 2, 1934. Because of restrictions on use of State funds outside State boundaries, no one from the University of Idaho attended, but their program was presented as usual. All other agencies engaged in forest and range research were represented.

ATTENDANCE

The individuals listed below attended all, or part, of the sessions:

FOREST SERVICE, REGION ONE.

E. W. Kelley,	Regional Forester and Chairman
Elers Koch,	Forest Management
D. S. Olson,	Forest Management
G. A. Smith,	Range Management
E. A. Shilling,	Range Management
M. H. Wolff,	Lands
R. H. Hammatt,	Public Relations
L. C. Stockdale,	Operation
F. J. Jefferson,	Operation
H. R. Richards,	Operation

FOREST SERVICE, NORTHERN ROCKY MOUNTAIN EXPERIMENT STATION

L. F. Watts,	Director and Secretary
R. H. Weidman,	Silviculture
Kenneth Davis,	Silviculture
L. C. Hornby,	Fire
H. T. Gisborne,	Fire
G. M. Jemison,	Fire
L. C. Hurtt,	Range
Fred Kennedy,	Range
M. I. Bradner,	Forest Survey
G. M. DeJarnette,	Forest Survey
I. V. Anderson,	Forest Products
C. N. Whitney,	Forest Products

UNIVERSITY OF MONTANA

I. W. Cook,	Acting Dean, School of Forestry
F. G. Clark,	Professor, School of Forestry
J. H. Ramskill,	Professor, School of Forestry
E. W. Nelson,	Professor, School of Forestry
C. W. Waters,	Professor, School of Forestry

MONTANA STATE COLLEGE

E. A. Starch,	Professor, School of Agriculture
Clyde McKee,	Professor, School of Agriculture
M. H. Saunderson,	Professor, School of Agriculture

OFFICE OF BLISTER RUST CONTROL, SPOKANE, WASHINGTON

Stephen N. Wyckoff, Senior Pathologist

C. C. Strong,

BUREAU OF ENTOMOLOGY, COEUR d'ALENE FIELD STATION

J. C. Evenden, Director

PACIFIC NORTHWEST SOIL EROSION STATION

W. A. Rockie, Regional Director

STATE OF MONTANA

Rutledge Parker, State Forester

PRIVATE AGENCIES

Roscoe Haines, A. C. M. Co., Missoula, Montana

J. Bruce Orcutt, Harriman-McIntosh Lands, Beebe, Montana

MATTERS OF GENERAL INTEREST

EXTENT OF RESEARCH BY ALL AGENCIES

The past year proved to be one of reductions in expenditures in regular appropriations and increases in total expenditures through the use of the various emergency funds. While this situation prevented the best planning of project work, and in some instances resulted in the initiation of other than the most urgent projects, it did enable the various agencies to make substantial progress. The unsatisfactory condition thus created makes the information contained in Table One somewhat misleading, in that the amount of research work actually accomplished exceeds that indicated by the expenditures listed.

NUMBER OF RESEARCH PROJECTS AND EXPENDITURES, BY LINES OF WORK
Northern Rocky Mountain Region

Calendar Year 1933
(Last half of F. Y. 1933 and first half F. Y. 1934)

Line of Work	AGENCY: Blister Rust Cont.		Bur. of Entomology		Montana Exp. Sta.		Univ. of Idaho		Univ. of Montana 3/		Weather Bureau 1/		For. Ser. Region 1		N.R.M. Exp. Sta.		Totals		Plant Investment N.R.M. Exp. Sta. C.Y. 1933
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	
Art. Reforestation							2	None					3	145			5	145	
Management							3	2,215							5	13,924	8	16,139	
Mensuration															3	2,980	3	2,980	7,621
Protection	8	27,109	9	13,000			2	1,951			3	3,500	1	3,000	2	24,033	25	72,593	
Products							3	2,835							5	9,754	8	12,589	
Grazing															1	7,790	1	7,790	
Artificial Reseeding															1	1,665	1	1,665	4,215
Economics					4 2/	6,500							1	50	2	19,363	7	25,913	
Ecology																			
Miscellaneous								865					2	400	3	1,646	5	2,901	
Totals	8	27,109	9	13,000	4	6,500	10	7,856			3	3,500	7	3,595	22	81,155	63	142715	11,836

1. Estimated.
2. Range and Land Use
3. No information submitted.

CIVILIAN CONSERVATION CORPS

The initiation of work by the Civilian Conservation Corps proved to be a distinct advantage to forest research. One entire camp was assigned to the Priest River Experimental Forest. This made possible the construction of approximately fourteen miles of road on the area, the thinning of about 30 acres of young white pine and the establishment of a series of seven thinning plots, the disposal of snags on about 100 acres of old burn, besides a long list of minor jobs. After July 1 several enrollees were selected for and used on research project work in lieu of the regular temporary men which had to be dropped because of decreases in regular allotments.

In Montana ten CCC enrollees were used for about two months on a thinning project in the ponderosa pine type on the Lolo Forest. About 20 acres were thinned and nine permanent plots were established.

During the third work period, April 1 to September 30, 1934, one full camp will be employed on work at Priest River Experimental Forest and one at the Deception Creek Experimental Forest.

Experimental work on the University of Idaho Experimental Forest was given great impetus by the establishment of a CCC camp on that unit during the winter of 1933-1934. Material progress was made in establishing stand improvement plots, planting poorly stocked or unstocked areas, fire-

proofing the area, and developing a road, trail and protection system.

NATIONAL INDUSTRIAL RECOVERY ACT

Much urgently needed work was made possible by appropriations under the National Industrial Recovery Act. At the Priest River Experimental Forest a new five-stall garage was constructed, a 150' weather observation tower was purchased, and the material is on the ground for constructing an additional three-room dwelling. At the Deception Creek Experimental Forest some 16 acres of 40-year old white pine were thinned, a series of seven permanent plots were established, more than 3,000 snags were felled on an old timber sale area, and about five miles of the main road across the area were fire-proofed.

At Fort Keogh, the office used by the Range Research personnel was remodeled, a new garage was constructed, and several miles of much needed fencing were completed. In addition, a good start was made on the artificial range reseeding project. NIRA funds allotted to research work late in the summer of 1933 enabled the Station to complete the program of work for the year.

Improvement plans for F. Y. 1935 call for the building of one five-room residence, one three-room residence to be used temporarily as an office, one five-stall garage and tool house, and a water system at the Deception Creek Experimental Forest.

At Priest River sufficient funds to construct the additional residence are provided.

CIVIL WORKS ADMINISTRATION

The Station was allotted 20 people in Montana and 25 in Idaho under the Civil Works Administration. In Idaho, the major project was the construction of 15½ miles of power line from Priest River to the Priest River Experimental Forest. Supplies and materials were purchased with NIRA funds. The construction work was practically completed with CWA labor. The Station is now supplied with electricity for lighting, heating, refrigeration, and power.

Qualified CWA workers were assigned to the various National Forest headquarters in Idaho and Montana to prepare standard 2"-to-the-mile type maps for the Forest Survey. This project was particularly helpful in preparing for the Survey field work for this summer and in clarifying our knowledge as to the amount and character of forest survey data available for the National Forests.

Clerical and computing help was made available for all of our project work and we are now more nearly abreast of the job in this field than for several years past.

One of the major projects completed with CWA help was the compiling for our records of all pertinent data secured by the Rural Housing Survey in Montana and Idaho. This information is yet to be analyzed but it should furnish much valuable knowledge for the Requirements Phase of the Forest Survey.

SELECTION OF RESEARCH AREAS

Little progress in this activity can be reported. Two areas were examined with a view to their withdrawal as natural areas, but final decision has not yet been reached in either case. The pressure of more urgent work precluded the allocation of much time or thought to this project. A preliminary examination was made of an area adjoining the Deerlodge Forest with the thought of its selection as a spring-fall range area. A more detailed study must be made this season before we can be sure that it is entirely suitable to our needs.

ARTICLE X OF THE LUMBER CODE

Much time was devoted to the preparation of woods practice rules for the various types represented in this Region. In this work the Station acted in the capacity of a consultant organization and made available all of the information in our files which would aid in working out practical rules for adoption by the industry. The data on selective logging, furnished by the office of Forest Products, was particularly valuable.

PROGRESS BY LINES OF WORK DURING 1933

FOREST MANAGEMENT

SILVICULTURE

WHITE PINE REPRODUCTION STUDY

This project was started in 1926 and now embraces 34 permanent plots, 1,149 quadrats, 4,696 tagged trees, 102 seed traps, seed-stored-in-duff installations, and great number of small quadrats of sowed seedlings dealing intensively with causes of mortality. Numerous examinations are made annually, requiring a five-man crew for entire field season. Recent noteworthy results are: (1) Mortality as high as 90 percent of all seedlings that germinate may occur in first three years, which signifies that abundant reproduction cannot be accepted as evidence of success until seedlings are over three years old; (2) adequate seed trees start enough seedlings from year to year to produce a satisfactory cover of reproduction; (3) seed stored in the duff is not viable after the second year and consequently reproduction from this source cannot be depended upon unless a heavy seed crop occurred within two years preceding cutting; (4) the causes of greatest early seedling mortality are drought and high ground-surface temperatures, the latter reaching 120° to 150° F. during the hottest periods; (5) the greatest losses occur in clear-cut and the least in half-shaded areas, indicating need of some shelter during the establishment period of reproduction.

WHITE PINE METHODS OF CUTTING

Twenty-six of the permanent plots used in the reproduction study also serve to determine suitable methods of cutting. Methods studied include selection, shelterwood, and seed-tree types of cutting, and several methods of handling the hemlock problem. The plots are not old enough yet to yield results on increment. A strip study of 32 old cuttings made several years ago has supplied increment cores from 2,814 trees, which furnish the basis for preliminary yield prediction in residual white pine stands.

PONDEROSA PINE METHODS OF CUTTING

Work on this project is restricted to three permanent plots to investigate possibilities of selective logging. They were established in 1932 at Greenough, Montana, in cooperation with the A.C.M. Lumber Company and other private and public agencies. The plots were logged according to clear cutting, economic selection, and silvicultural selection methods. The Forest Products section of the Experiment Station is preparing for publication the data from the logging and milling phases of this study. The Silviculture section will conduct the periodic remeasurements of plots for growth and reproduction.

WHITE PINE GROWTH AND YIELD

This project includes 31 permanent and 56 semipermanent plots, established mostly between 1922 and 1926. Remeasure-

ments are made at five and ten-year intervals to determine growth, yield, and development of young stands. Five plots were remeasured in 1932 and seven in 1933.

PONDEROSA PINE GROWTH AND YIELD

This study is a part of an interregional project to collect data for preparing even-aged, normal-yield tables, by site classes, for the entire range of the species. Thirty-three temporary plots were established by this Station in 1932 and three in 1933. Behre's 84 plots, selected in southern Idaho about 10 years ago, will also be used.

LARCH-DOUGLAS FIR GROWTH AND YIELD

Work on this project is confined to a study of growth of residual stands. Thirty temporary plots were selected in 30-year-old cuttings near Kalispell, Montana, in 1932. No work was done in 1933. Compilation of the data indicates an average annual growth of 70 board feet per acre where less than 2,000 feet were left in logging and of nearly 200 board feet per acre where 2,000 to 4,000 feet were left.

WHITE PINE THINNING METHODS

This project includes 25 permanent plots, 11 of which were established between 1914 and 1926. CCC and NIRA thinning activities made possible the establishment of 14 plots in 1933. Compilation of records of the older plots in stands over 60-years old indicate no signi-

ficant increase in yield over unthinned plots, but do show increased size and quality and greatly increased proportion of desirable species in crop trees.

PONDEROSA PINE THINNING METHODS

Nine plots were established in 1933 in connection with a thinning project conducted with CCC labor 20 miles from Missoula, Montana.

BOTANICAL STUDIES

This group of studies includes an arboretum of 160 acres at Priest River. Individual species are planted in blocks of one-fourth to one acre in size. Four blocks were planted in 1932 and 24 blocks in 1933. The project also includes 19 blocks of ponderosa pine racial varieties from points throughout the range of the species. Another phase of the project deals with phenological observations at 13 stations in Montana and northern Idaho.

FIRE RESEARCH

BEHAVIOR STUDIES

During the past two years the most outstanding progress in measuring fire danger has been along three lines: fundamental studies, instruments, and application to research results.

First, as a result of Jemison's eight months' detail to the Washington Office, an intensive study employing ad-

vanced statistical methods of analysis is well under way and is already producing much new, more dependable, and fundamentally important information.

Second, a new instrument has been produced which will provide a continuous record of (1) duff moisture, (2) wood moistures, and (3) wind velocity. This instrument will make it possible to obtain records of these important factors of fire danger at administrative stations not continuously occupied and will also be used in a much-needed research investigation of fire danger on north versus south slopes by elevation classes. Another instrument developed recently is an inexpensive wind gauge for use at numerous field stations where it was impossible to provide the standard four-cup anemometer costing $75. The new gauges cost less than $3.00 each and are accurate to within one or two miles per hour for velocities between two and twenty-eight miles per hour. The supervisors of the National Forests in Region One have ordered 147 of these gauges.

The third line of progress has been in the application of all these measurements of fire danger by use of the Fire Danger Meter. This device was given a field trial in 1932, and after slight revision was used daily on the 13 fire Forests throughout the 1933 season. As one result, it was possible for the first time to rate the character of a fire season on a numerical basis. The Supervisors also used this

method in their daily reports of the status of fire danger.

Further progress also has been made in the application of research results by the addition of about 30 more inflammability stations in this Region, together with two in the National Parks and seven in R-4. These stations use 19 duff hygrometers and 38 sets of wood cylinders.

ATTACK

This project is divided into three phases: (1) determination of fire-control requirements by analyzing records of all fires which occurred between 1921 and 1930, inclusive; (2) the determination of the best distribution of fire-control endeavor (men and facilities) proportional to actual needs; (3) the collection of data in the field and the preparation of plans for fourteen million acres of eleven overburned forests. A total of 150 men was trained for assistance in these two latter tasks.

Fire-control preparations and fire-suppression activities increase as periods of drouth continue. For each of five degrees of severity of burning conditions the stations to be occupied and the man-power to be placed to each have been specified. The individual construction projects (roads, trails, etc.) needed have been determined and rated in priority according to service rendered, permitting efficient allocation of funds.

The man-hours required to suppress any fire increase with the time between discovery and attack. Therefore, it was necessary to study the fuel types in order to predict the probable rate of spread of small fires and the rate at which men could construct fire line (resistance to control). Therefore, the entire area for which plans were made was covered by a fuel-type map in terms of probable rate of spread and resistance to control.

Allowable travel time was worked out, correlating severity of burning conditions with fuels and strength of attack. The travel time limits, hence the area assignable to one or more men, can be expanded by new roads and trails.

The dual responsibilities of detection and smokechasing were assigned to every station. The occupant of every point views a certain area and chases smoke on an area which may or may not be the same as the seen area. By studying different combinations of stations it was possible to select the fewest number of stations to give the greatest total coverage for five types of organization. Similar coverage studies were made for small and large crew reinforcement attacks, assigning travel time limits to communities varying with available dependable man-power and the fuels to be covered.

The selection of the best composite coverage was accomplished by making silhouettes of individual station cover-

ages. These were then stacked together in various combinations for sorting over a glass-top table lighted from beneath. For detection coverage the areas seen from 5,000 potential stations were mapped and studied, from which approximately 600 were selected as fitting best into composite relationships. The existing improved stations that fitted reasonably well into composites were retained. In spite of concessions it was found that between 5 and 10 percent of the existing stations could not be retained in any efficient combination. It was more economical to abandon them.

The coverage obtained by this method, as compared with the method of personal judgment previously used, shows that a cut of 20% (not less than $50,000 per year) in funds for manpower would provide as good coverage as before. This does not mean that such coverage would be satisfactory because the previous organizations were not strong enough to hold the area burned to acceptable limits. However, it does mean that this project has shown how to use most efficiently whatever funds may be available. In addition, and perhaps still more valuable, 100 men have been trained to think and work more analytically.

The total cost of this planning during the past three years has amounted to approximately $140,000, or about one cent per acre covered. It is evident that the project will repay its cost many times by the indicated permanent reduction of $50,000, or more, annually.

RANGE RESEARCH

Range Research by this Station started from scratch in 1932 under a cooperative agreement with the Bureau of Animal Industry at old Fort Keogh, near Miles City, now known as the U. S. Range Livestock Experiment Station. The first appropriation bill limited work to old Fort Keogh. Subsequently, there have not been enough regular range investigative funds to expand to National Forest ranges. Emphasis has been placed almost exclusively on one project, Management of Short Grass Ranges, with a very small amount of work on the second project, Artificial Range Reseeding.

Under the first, a series of twelve pastures have been set up and are being grazed, six in summer and six during the winter, to determine the correct utilization practice, as well as comparative cattle production efficiency under three intensities of use--overgrazing, moderate grazing, and undergrazing. Weight data at approximately monthly intervals on three lots of twenty young range cows have been obtained during the past eighteen months, and the reaction of the vegetation in the different pastures has been measured by quadrats, height and volume measurements, etc.

Overgrazing during the past two seasons has not yet perceptibly damaged the range. This treatment has, however, reduced meat production per cow unit by 53.5 pounds during five months of 1932, and 56.5 pounds during the 1933 grazing

year, a total of 112.0 pounds, as compared to those cows that had ample range forage. Thus at 4¢ per pound, a gross financial penalty of $4.48 per head was suffered by the producer in less than two years. At ten cents per acre lease price, the extra range used under conservative grazing would cost $1.48 for two years, leaving a net penalty of $3.00 per head due to overgrazing. This occurs before damage to the range is clearly demonstrable. A financial, as well as altruistic, motive for conservative range use, as against overgrazing is thus provided by these data.

Limited artificial reseeding work on plowed and abandoned ranges has proved that crested wheat grass is well adapted to a wide range of soils in the harsh Miles City climate. Reseeding work is being expanded under NIRA funds to National Forests and under cooperative agreements to certain privately owned lands that have been abandoned to cultivation. Various other species are being used in these tests which are considered as demonstrations in most cases, rather than truly research in character.

FOREST SURVEY

The Forest Survey is an economic study of the timber supply situation from both the national and the regional viewpoints. It is a study of present supply with relation to local industry, transportation, and finance, and an attempt to forecast future supply and possibilities from an analysis of

depletion and growth trends, all in the light of domestic requirements, present and prospective, for forest products. When completed, the following results will be available:

1. Inventory Phase: The area of each type of forest cover and the estimated stand by species. Regrowth conditions on cut-over and burned lands will be determined.

2. Depletion Phase: Rate of depletion by cutting, fire, insects, disease, floods, and any other factors.

3. Growth Phase: Growth rate in old stands and on restocking areas and probable future yields.

4. Requirement Phase: Present national and local requirements in forest products and probable trends.

The Forest Survey organization of this station plans, as the first project, to cover the Inland Empire region. That part of Montana east of the continental divide will be handled as a separate project. The Inland Empire region includes the forested area in Montana west of the continental divide, Idaho north of the Salmon River, and Spokane, Pend Oreille and Stevens Counties in northeastern Washington, containing approximately 25½ million acres of forest lands. Fifty-three percent of the above area, or 13½ million acres, is in the National Forests. Inventories of varying degrees of intensiveness have been made of the forest resources within these National Forests. At the start of the project practically no information, except that of estimates on merchantable timber, was available for the 12 million acres of public and privately owned forest lands outside the National Forests.

The most time-consuming phase of the project and the one put under way first was the inventory of the present forest stand. Small regular appropriations have made it impossible to build up an organization large enough to function efficiently. To date, however, 1½ million acres of public and privately owned forest lands, mostly in Idaho, outside the National Forests, have been typed in place and cover maps prepared. In addition, the estimates on some 900,000 acres of merchantable timber have been collected from State and private owners. The estimates on approximately 170,000 acres of the above timber have been adjusted to Survey standards by checking in the field.

Considerable information has been obtained on the Requirements Phase of the Survey through studies of building construction and contractors' records in the larger cities of the Inland Empire, and of the timber requirements of public utilities. Depletion data are collected annually by the Products, Fire, Blister Rust and Insect Control Offices within the Region. No work has yet been initiated on the Growth Phase of the Survey.

FOREST PRODUCTS

Forest Products research, as now handled by the Northern Rocky Mountain Experiment Station, is designed to be of maximum service to the industry and the Government in the field of economics of forest products production.

The projects now under way are carried under the following main designations: (1) Logging and Milling Studies, (2) Woods and Mill Utilization, (3) Species Utilization, (4) Wood Preservation, (5) Forest Statistics, and (6) Special Studies.

The logging and milling studies, (1) selective logging and (2) logging output studies, provide information on the important phases of forest products production. The final results of the selective logging studies will show for each commercial type in the region and for individual holdings, the cutting limits and utilization standards necessary to provide a reasonable profit for the operator. The logging output studies are designed to measure the output of new logging equipment and new logging methods. Eight selective logging studies have been undertaken, five in the ponderosa pine type of western Montana, two in the white pine type, and one in the larch-Douglas fir type. Work during the past year, which will continue during 1934, covered the compilation, analyzing and preparing for publication, all the data now available on the subject. All of the logging output data secured up to 1931 have been published as Technical Bulletin #355. The studies will be continued as the opportunity presents itself.

The woods and mill utilization studies furnish information pertaining to overrun data, efficiency comparison of logging and milling equipment, waste investigations, and de-

preciation studies. The results of previous studies on overrun, sawmill efficiency, residual wood after logging, breakage in felling and depreciation through river driving, gravity chuting, and fire have been made available to the northwestern lumber industry.

The species utilization studies are designed to promote the good utilization of certain little-used species, thereby increasing the economic value of the source of our present timber supply. Bulletins on western hemlock, western larch, and white fir have been published as a result of cooperation by this office, the Forest Products Laboratory, and adjacent Experiment Stations. Preparation of the manuscript on lodgepole pine has been postponed because of recent serious insect losses in the species and the present economic conditions in the lumber industry.

Cost data and other information resulting from the Regional wood-preserving studies have been widely used in treating telephone poles, fence posts and stubs required in the constructing and maintaining of Forest Service improvements. Other Federal agencies, as well as some commercial companies and private individuals, make use of the basic information obtained from these studies. Many of the service test studies have been under observation for a great many years and are providing the only reliable data that can be obtained on the

durability of treated and untreated woods in actual service and the efficiency of various preservatives and methods of treatment.

Current data are obtained on the amounts produced, production costs, and selling values of the forest products cut and manufactured within the Region. These data are used in figuring the sale value of Government-owned timber by the Federal agencies in Washington, Oregon, Idaho and Montana. Statistical information collected and compiled by this Station is used extensively by the Government agencies and the industry within the Region in many special reports.

Results of investigations carried on by the Section of Forest Products have proved of much value during the past few months in furnishing the basic data for setting up the woods practices necessary for keeping forest land productive under Article X of the Lumber Industry Code.

PLANS FOR FISCAL YEAR 1935

In presenting the plans for the work of the Station for fiscal year 1935 no attempt will be made to segregate the work by the various appropriations from which funds are obtained. It is of interest to note that regular funds have now been reduced to the point where they will barely carry our permanent personnel, leaving almost nothing for travel and equipment. No temporary assistants can be financed from

regular funds. In Range Research, the allotment is barely enough for the two project workers without allowing anything for station overhead expenses. The work of the Forest Survey is, of course, financed entirely from emergency funds.

FOREST MANAGEMENT

The coming season's work in Forest Management will be greatly influenced by our plan to devote the major effort of our our regular personnel to the analysis and publication of results. Excepting Gisborne, the field time of our Forest Management staff will be limited to absolutely essential supervision of going projects. We are fortunate in having available trained temporary men who can carry our field work for one season without agreat deal of supervision. Haig will devote almost his entire time to the preparation of reports on the intensive seedling survival study, the growth on white pine cut-over lands project, and in assisting Weidman on a white pine silviculture bulletin. Weidman will start the ponderosa pine yield and larch-fir growth crews in their work and will spend the balance of his time on the White pine bulletin. Watts, with the help of Davis, Thompson and Professor Latham, will direct the stand improvement studies at the Priest River and Deception Creek Experimental Forests. Gisborne will handle the field phases of our fire behavior studies, leaving Jemison free to work on the statistical analysis of the factors affecting fire danger. Hornby will divide his time between the field supervision of the visibility and man-power placement

studies and the preparation of a manuscript covering his work in these fields during the past three years.

WHITE PINE REPRODUCTION STUDY

The regular examinations of 1,149 reproduction quadrats, the recording of the cone crop of 4,696 tagged trees, the collection of seed from 102 seed trees and the testing of viability of seed stored in the duff will be continued.

The intensive seedling survival study, under way at Priest River, will be continued and will be expanded to include second year survival and survival on steep slopes.

WHITE PINE METHOD OF CUTTING

The scheduled examinations of permanent plots will be completed and a report on certain phases of this project will be prepared for publication.

We hope, with the aid of CCC forces, to experiment with a new silvicultural system in overmature climax white pine. The questions involved have to do more with the practicability of logging under the proposed plan than with the silvicultural results obtainable. The accepted practice in such stands is to remove merchantable material, slash the residual defective hemlock, white fir and cedar, broadcast burn, and plant. Under the proposed experiment we will first dispose of the defective material, leaving all white pine for 3 to 5 years, until the area is completely restocked with seedlings, and then clean

out the white pine. If this method provies feasible, it will eliminate the necessity for broadcast burning and planting. Even though the cost may be greater than under the present method, the elimination of the damage to the soil by broadcast burning and the nazards of securing a second crop by planting, may make the proposed system desirable in certain stands.

WHITE PINE MENSURATION

The only work planned for this project is the remeasurement of seven permanent plots.

PONDEROSA PINE MENSURATION

Apprxoimately two months by a crew of three men will be spent on this project. It is planned to secure about 100 additional normal yield plots divided between Montana and the Black Hills. This will make about 133 plots in addition to the 84 plots measured by Behre some years ago. Upon completion of the field work the data will all be forwarded to Mr. Meyer of the Pacific Northwest Station for inclusion in the interregional yield table.

LARCH-DOUGLAS FIR MENSURATION

Upon completion of the ponderosa pine yield study field work, the same crew will continue with the larch-fir study of growth after cutting. It is hoped to get about 80 additional plots in the Flathead, Kootenai and Missoula River valleys. This should give a fairly usable preliminary basis

for the prediction of yields after cutting in this type.

WHITE PINE METHODS OF THINNING

After completion of the blister rust control work, about September 15, a part of the CCC force at Deception Creek and at Priest River will be used to continue our white pine thinning studies. Emphasis will be placed on the work in younger ages. One area of 10-15 year old pine at Deception Creek has been selected for a study of the effect of removal of competing hemlock saplings, and areas of 40-year old pine have been tentatively selected for thinning at Priest River and Deception Creek. Detailed plans for the work will be prepared during the summer.

BOTANICAL STUDIES

Several additional blocks in our Priest River arboretum will be planted during the year. No attempt is made to stress this project unduly so long as reasonable progress can be made each year.

The phenological observations will be continued at a limited number of stations. A review of results to date has clearly shown that quality, rather than quantity, of observations will determine the usability of the data.

FIRE BEHAVIOR STUDIES

Plans for 1934 include (1) concentration of Jemison's time on the analysis of the data showing the relation of weather elements to duff and wood moisture on clear-cut, half-

cut, and full-timbered areas; (2) calibration of the 147 wind gauges, 19 duff hygrometers and 33 sets of wood cylinders, and the personal checking by Gisborne of the location and operation of all 41 stations in this Region; (3) development of a standard exposure for hygrometers and cylinders so that the degree of danger shown by the various stations will be more nearly comparable; (4) initiation of the study of differences in danger on north versus south slopes by elevation; (5) improvement of the Fire Danger Meter by incorporating a new factor, green vegetation, which will probably require more than one season to develop; (6) continuation of the operation of the three standard stations at Priest River, and (7) the initiation of an intensive study of the effect on fire danger of seasonal and yearly variations in the amount and condition of understory vegetation.

FIRE ATTACK

The work planned under this project will consist of the preparation of a complete report showing the technique followed, and results obtained, from the so-called "Fire Control and Transportation Planning" study. Approximately half of Hornby's time, until early winter, will be devoted to this work. The balance of his time will be devoted to (1) the supervision of a field study of atmospheric transparency as related to visibility in this region, (2) the direction of the work of smoothing out difficulties which have shown up in the various forest plans already made, (3) the carrying of the plan over to private and State holdings in northern Idaho. This last phase

will provide an opportunity for applying the methods worked out to an area consisting largely of cut-over lands, or lands on which cutting will shortly take place. The difficulties of integrating the requirements incident to logging operations, which are covering new territory each year, with those for virgin timber will be many.

RANGE INVESTIGATIONS

With rather ample emergency funds, the work in range investigations can be expanded at least temporarily. The work planned is divided into three main projects.

MANAGEMENT OF SHORT GRASS RANGES

This project will be continued at Fort Keogh as during the past two years, except that sufficient help will be available to complete the installation and checking of the required number of quadrats in the twelve pastures. An attempt to stimulate the interest of the stockmen in this project will be made, either during the Montana Livestock Convention to be held in Miles City in May, or by arranging a small stockmens' field day later in the season.

ARTIFICIAL RESEEDING

This project includes the investigation of the possibilities of quick revegetation of depleted and overgrazed natural range lands and the establishment of profitable range forage on abandoned dry farm wheat lands now producing only

worthless weeds.

Experimental sowings under the first condition are confined largely to the Range Livestock Experiment Station at Miles City, and to selected areas on the National Forests where proper protection, including fencing, is assured for the first few years.

Obviously, the rehabilitation of abandoned wheat farms must be conducted on private lands. Cooperative agreements, covering a period of five years, have been or will be executed with interested land owners. We will furnish the seed, decide on species and methods of sowing, in some instances bear part of the expense of fencing, determine the grazing use which may be allowed during the period, and make the necessary examinations. The land owners will furnish the equipment, sow the seed, and in most instances, fence the area to prevent abuse by stock. Fifteen to twenty experimental areas are contemplated in perhaps 10 or 12 counties in eastern Montana. Both spring and fall sowing has been planned. Crested wheat grass will be the main species used, although some 10 or 12 other species will be given a thorough trial.

The comparative values of various species will be thoroughly tested at Miles City, where a rather comprehensive series of acre plots have been arranged.

DEGREE OF DETERIORATION OF UNMANAGED RANGES

In order to determine with some degree of accuracy, the present condition of unmanaged as compared to managed ranges, an intensive range reconnaissance of about 70,000 acres of land adjoining the Deerlodge Forest will be completed. The area, known as Rochester Basin, is typical spring-fall range and not unlike a part of the adjoining National Forest land covered by intensive reconnaissance last year. More than 60% of the area is public domain. The detailed data secured should be very useful in setting up administration of this and other similar range land.

Incidentally, this area was examined in a preliminary way with the thought that it might be a desirable location for a spring-fall range research substation. The data to be secured by this survey will enable us to make a final decision on this point.

FOREST SURVEY

The Forst Survey will go forward this year at a satisfactory rate. The allotment of emergency funds, both NIRA and ECW to this project, will enable us to employ about 24 mappers and perhaps two or three check cruisers. Funds are also available to hold about 8 men for office compilation during the winter of 1934-1935. It is planned to complete about 10 million acres this season, which, together with the 3 million acres already done, will cover about half the

timbered area in the Inland Empire. The study of timber requirements for building construction on the farms and in the cities, as well as that for other large users, will be continued during F. Y. 1935. Depletion data will be collected by the Products, Fire, Blister Rust and Insect Control Offices within the Region.

FOREST PRODUCTS

LOGGING AND MILLING

While no new field projects are definitely planned, it is very probable that selective logging studies in the larch-fir and white pine type will be demanded because of the lack of usable data for the enforcement of the provisions of Article X of the Lumber Code. The only basis on which we could undertake such studies now would be that the expense, other than our regular salaries, be paid from funds allotted for Code enforcement, or from cooperative contributions by the industry. If no demand for additional studies arises, our efforts will be devoted to the completion of the Ohio Match Company study and the preparation of a ponderosa pine selective logging bulletin based on the several individual studies completed to date. The necessity and desirability of assisting in working out forest practice rules under the Code may place such a burden on our Products organization that little additional work can be accomplished. Inasmuch

as the initiation of the practice of forestry on private lands is of first rate importance, I see no objection to the fullest kind of cooperation by our Products staff.

WOODS AND MILL UTILIZATION

No special program of work is planned under this project other than incidental time required for inquiries from various agencies concerning woods and mill utilization in this region.

WOOD REQUIREMENTS

This project has been advanced materially during the past year by securing information from the Federal Civil Works Farm Housing Survey. Detailed data for four counties in Idaho and six counties in Montana were copied from the original schedules and are now available for analysis in our office. It is planned to supplement these data with additional material on requirements for fuel, fencing, and outbuildings by sending out questionnaires to a random sample of those farms visited during the Rural Housing Survey. If this fails we will obtain the data in accordance with Mr. Hallauer's work plan. Half of Mr. Whitney's time is available for this project.

WOOD PRESERVATION

Collection of service records for treated and untreated timbers will be continued. Eight test installations are up for examination this year.

If arrangements can be made, test installations to determine the effectiveness of petroleum oil, containing tetrachlorophenol or orthophenylphenol will be initiated. This study has been suggested by Mr. Hunt of the Forest Products laboratory in connection with some of our fencing projects.

STATISTICS ON FOREST PRODUCTS

It is planned to continue all phases of this project as usual, except that no financial cooperation by the Census Bureau is contemplated.

EXPERIMENT STATION PERSONNEL

Lyle F. Watts . . . . . Director

Forest Management

R. H. Weidman	Sr. Silviculturist	Silviculture
I. T. Haig	Assoc. "	
H. T. Gisborne	Silviculturist	Fire Research
L. G. Hornby	Reg. For. Inspector	
G. M. Jemison	Jr. Forester	
J. B. Thompson	Jr. Forester, Priest River Branch Sta.	
Kenneth Davis	Jr. Forester, Deception Creek " "	

Range Research

L. C. Hurtt	Assoc. Range Examiner
Fred H. Kennedy	Jr. " "

Forest Products

M. I. Bradner	Sr. Forester
I. V. Anderson	Assoc. Forester
C. N. Whitney	Asst. Forester

Forest Survey

M. I. Bradner	Sr. Forester
G. M. DeJarnette	Asst. Forester

Clerical

M. J. Pershina	Chief Clerk
L. J. Hinton	Clerk-Stenographer
Marie E. Bouchard	Jr. Clerk
Dagmar Duncan	Jr. Clerk-Stenographer

Regional Assignees

R. L. Space	Fire Research
C. B. Sutliff	

EXPENDITURES F.Y. 1934
(Estimated to 6-30-34)

Lines of Work	Regular Research Funds	Regional Contributions	Coop. Funds	Emergency Funds			
				Resnira	ECW Research	Impnira	CWA
Forest Management							
B-1 Botany	153						
M-1 Management White Pine	4946	5398		1000	600	1300	1072
M-2 Management Pond. Pine	1488	1013			600	350	
Mt-1 Thinning White Pine	2640						
ME-1 Mensuration White Pine	500			2000			
ME-2 Mensuration Larch-Fir	47			1000			
ME-3 Mensuration Pond. Pine	343			740			
Pf-1 Attack	8300			1500	500		
Pf-2 Behavior	6537			1850	700		80
Lumber Code	336						
Plant Inves. Pr.R.-Decep. Cr.						9623	5192
Total	25290	6411	949	8090	2400	11273	6344
Range Investigations							
Mgt. Short Grass Ranges	5650			2700	2500	5520	231
Artificial Reseeding						3000	
Total	5650			2700	2500	8520	231
Forest Economics							
Forest Survey - Idaho	7072	16697			1500	5762	1366
Montana	4400	5267			1500	6761	3044
Washington	1200	2160			1000		
Total	12672	24124			4000	12523	4410
Forest Products							
Logging & Milling Studies	5009	200					629
Woods & Mill Utilization							
Wood Preservation	600						
Species Utilization	65						
Statistics	2580						400
Special Studies	1700						
Total	9954	200					1029

73,566

Form No. 1.

RESEARCH PROJECT ALLOTMENT SHEET

Northern Rocky Mountain Forest & Range Experiment Station

Fiscal Year 1935

Sub-Appropriations and Projects	Regular Research Funds	Regional Contributions	Coop. Funds	Emergency Funds		
				Resnira	ECW Research	Impnira
Forest Management						
B-1 Botany	1231					
M-1 Management White Pine	8358	5840		2500	2000	
M-2 Management Pond. Pine	280					
Mt-1 Thinning White Pine	468					
ME-1 Mensuration White Pine	936			500	375	
ME-2 Mensuration Larch-Fir	187			800	625	
ME-3 Mensuration Pond. Pine	375			1000	800	
Pf-1 Attack	5374			500	2000	
Pf-2 Behavior	8504			1000	800	
Total	25713	5840		6300	6600	(1) 12750
Range Investigations						
Mgt. Short Grass Ranges	5829			800	5500	5943
Artificial Reseeding						4500
Total	5829			800	5500	10443
Forest Economics						
Forest Survey - Idaho	(2) 5443	6000			4000	6000
Montana	5444	3773			3000	5000
Washington		4400			4000	
Total	10887	14173			11000	11000
Forest Products						
Logging & Milling Studies	4970	1000				
Woods & Mill Utilization						
Wood Preservation	250					
Species Utilization						
Statistics	3906					
Special Studies	1500					
Total	10626	1000				

(1) Plant Investment at Priest River and Deception Creek Experimental Forests.
(2) Lunira money.

Form No. 3

ESTIMATED DISTRIBUTION OF DIRECT
AND OVERHEAD EXPENDITURES

Northern Rocky Mountain Forest & Range Experiment Station

Fiscal Year 1935

Allotments	Forest Management	Range Investigations	Forest Products	Forest Survey	Total
	Dollars	Dollars	Dollars	Dollars	Dollars
Regular Research	25,713	5,829	10,626	10,887	53,055
S&E Region One	840				840
Impnira (Half of Total)	19,050	11,243		*25,173	55,466
ECF Research (Esti. (Bal. as of 7/1/34)	6,600	5,500		11,000	23,100
ECF Region One	5,000				5,000
TOTAL	57,203	22,572	10,626	47,060	137,461
Per Cent of Total	41.6	16.4	7.7	34.3	100.0
Proportionate Share of Overhead	Dollars 4,826	Dollars 1,906	Dollars 893	Dollars 3,979	Dollars 11,600

*This includes R-1 contribution to Forest Survey.

PUBLICATIONS

PUBLISHED SINCE LAST REPORT

1. An analysis of Log Production in the Inland Empire Region. Bradner, Girard, Fullaway and Klebucher. Technical Bulletin #355, June, 1933.
2. Fire Scarred Ponderosa Pine - What is the Loss? I. V. Anderson. The Timberman. April, 1934.
3. Residual Wood After Logging in the Western White Pine Region. I. V. Anderson. A mimeograph article. Sept. 1933.
4. Residual Wood After Logging in the Ponderosa Pine Region. I. V. Anderson. A mimeograph article. Sept. 1933.
5. Residual Wood After Logging in the Larch-Douglas Fir and Lodgepole Pine Type. I. V. Anderson. A mimeograph article. Sept. 1933.
6. Breakage Losses and Cull Per Cent of Timber in the Inland Empire. I. V. Anderson. Technical Note. No. 63. April, 1934.
7. An Economic Tree Classification for Ponderosa Pine. I. V. Anderson. Technical Note. No. 64. June, 1934.
8. Treatment of Understory Hemlock in the Western White Pine Type. I. T. Haig. Jour. For. May 1, 1933.
9. The Wood Cylinder Method of Measuring Forest Inflammability. H. T. Gisborne. Jour. For. Oct. 1933.
10. Progress in Forest Fire Research. H. T. Gisborne. Northwest Science, Sept. 1933.

11. Measuring Forest Fire Danger. H. T. Gisborne. Quarterly of the Nat'l Fire Protection Assoc. April, 1934.

12. Mrs. Robot is on Duty In Nearby Forests. H. T. Gisborne. Feature story, Spokesman Review, Aug. 1, 1933.

13. Deadwood Lying on Duff Drier than in Air. H. T. Gisborne. Jour. For. Dec. 1933.

14. Lightning and Forest Fires. H. T. Gisborne. Pulp and Paper of Canada. May, 1933.

15. The Significance of the Effect of Stand Density Upon the Weather Beneath the Canopy. G. M. Jemison. Jour. For. April, 1934.

16. Progress of Research in Silviculture in the Inland Empire. R. H. Weidman. Northwest Science. Sept. 1933.

17. Idaho-Montana Lumber Cut (Preliminary Statement based on returns from 1932 Lumber Census). C. N. Whitney. The Timberman, July, 1933.

18. How Big is a ~~Livestock~~ Profitable Ranch? L. C. Hurtt. The Montana Farmer. Mar. 1, 1934.

SUBMITTED FOR PUBLICATION

1. Timber Growing and Logging Practice in Ponderosa Pine in the Northwest. R. H. Weidman. Tech. Bulletin. To Washington June 5, 1934.
2. Some Climatic Effects on Forest Stands and Forest Types. R. H. Weidman. To Northwest Science, 1933.
3. Application of Selective Logging to a Ponderosa Pine Operation in Western Montana. I. V. Anderson. State University of Montana, Technical Bulletin. June, 1934.
4. Clean Cutting of Ponderosa Pine Versus Selective Cutting. I. V. Anderson. Jour. For. March, 1934.
5. Fuel Type Mapping. L. G. Hornby. Jour. For. Jan. 1934.
6. Beaufort Scale of Wind Force as Adapted for Use on Forested Areas in the Northern Rocky Mountains. G. M. Jemison. Jour. Ag. Res. March 5, 1934.
7. The Measurement of Fire Weather and Forest Inflammability. H. T. Gisborne. Submitted to Washington Office February, 1934. Gov't circular.
8. Overgrazing Increases Cattle Production Costs. L. C. Hurtt. Submitted in February, 1933 to producer.
9. A Method of Determining Spacing in Thinning. Kenneth Davis. Jour. For., March 13, 1934.

IN PREPARATION OR PROPOSED FOR F. Y. 1935

1. A Silvicultural Study of Western White Pine.
   R. H. Weidman and I. T. Haig. Technical Bulletin.
2. Some Aspects of Succession in the Ponderosa Pine Forest. R. H. Weidman. Ecology.
3. Sources of Regeneration Following Fires in the Western White Pine Type. R. H. Weidman. Jour. For.
4. Reproduction and Residual Growth on Cut-Over Areas in the Western White Pine Type. I. T. Haig. Final Report.
5. Factors Affecting Early Seedling Survival in the Western White Pine Forest. I. T. Haig. Doctorate Thesis.
6. Travel Time in Fire Control, Based on Fuel Conditions.
   L. G. Hornby. Jour. For.
7. Rating Areas in Relative Fire Danger.
   L. G. Hornby. Jour. For.
8. Planning the Placement of Man-Power, Roads and Trails for Fire Control. L. G. Hornby. U.S.D.A. Bulletin.
9. Measuring Forest Fire Danger. H. T. Gisborne and G. M. Jemison. U.S.D.A. Misc. publication.
10. A Ten Year Record of Lightning and Forest Fires.
    H. T. Gisborne. Mo. Wea. Review.
11. Overgrazing Reduces Gains and Increases Cattle Production Costs. L. C. Hurtt. U.S.D.A. Yearbook article.
12. Summary of Reseeding Work. L. C. Hurtt. U.S.D.A. circular.

13. The Effect of Climatic Conditions on the Seasonal Growth and Development of Some of the Important Forage Grasses of the Northern Great Plains Region. Fred H. Kennedy. Article.

14. Forest Situation in Benewah County and Kootenai County. G. M. DeJarnette. Article.

15. Conversion Value of Idaho White Pine Commercial vs Match Plank. I. V. Anderson. Trade Journal article.

16. Possibilities of Selective Cutting in Larch-Douglas fir Stands of Western Montana. I. V. Anderson. Trade Journal article.

17. Log Grades for Ponderosa Pine. I. V. Anderson. The Timberman.

18. Trees That Are Logged at a Loss. I. V. Anderson. The Timberman.

19. Basic Information for the Practice of Selective Logging in the Ponderosa Pine Forests of the Inland Empire. Anderson and Bradner. Technical Bulletin.

20. Production of Lumber and Timber Products in Idaho and Montana, 1933. C. N. Whitney. The Timberman.

21. Service Records of Experimental Fence Posts at Miles City, Montana. C. N. Whitney. The Montana Farmer.

22. Durability of Cross-ties in Montana Test Tracks. C. N. Whitney. Applied Forestry Notes, N.R.M. Forest & Range Experiment Station.

RS-NRM

PROJECT: B-1: Forest Botany, (formerly B-Phenology, B-Arboretum, Fs-101).

SCOPE: Arboretum area of 160 acres at Priest River Branch to test exotics and other non-native species for adaptability in northern Idaho. A plantation at Priest River Branch containing races of ponderosa pine from 19 localities ranging from the Black Hills to the Siskiyou Mts. and from northern Idaho to Arizona. Thirteen phenological stations in Montana and northern Idaho to obtain knowledge on time and conditions of seasonal vegetative events.

STATUS: Arboretum plan calls for planting species in blocks of ½ to 1 acre in size. Four blocks were planted in 1932. Twenty-four blocks, comprising 18,000 trees, were planted in 1933. In addition, four larger blocks were established in 1933, in which deep and shallow rooted species were planted in alternate rows. The racial plots of ponderosa pine were established from 1911 to 1917 and the last report was by Kempff in December, 1927. Phenology stations established in 1928 and observations being made annually by local forest officers. Part of records of first 5-year period compiled in 1933.

RESULTS OF PAST YEAR: Included in remarks under STATUS.

PLANS F. Y. 1935: Plan is to plant 25 additional blocks (20,800 trees) in arboretum in spring of 1934. Fail places to be planted in all other blocks to extent of 11,000 trees. Work will be limited by availability of stock ordered from various nurseries. Remeasure ponderosa pine racial plots if opportunity is afforded. Continue phenological observations in field; analyze records of first 5 years and prepare progress report if time is available.

ASSIGN-MENT: Weidman and Thompson.

PROJECT: M-1: Management of western white pine type, (formerly Mc-102, Mr-102, TS-102, M-Priest River).

SCOPE: To determine the factors controlling regeneration in the white pine type, with particular attention to seed production, dissemination, storage, germination and seedling establishment. To determine suitable methods of cutting to secure satisfactory reproduction of the desired species, and the best development of residual stands.

STATUS: 1. Strip study of old cut-over areas: Field work on 32 areas between 1925 and 1928. Reproduction data secured on 2,145 quadrats. Increment records obtained from 2,814 residual trees on 158 plots. Additional increment records on 3433 trees available from Regional Office timber sale studies. Comprehensive coverage of areas included 8 miles of continuous strip to determine percentage of area stocked and 496 chains of cruise to produce data for stand tables. Shelterwood, seed-tree, and clear-cut areas included. Compilation and analysis complete. Brief preliminary report available for field use.

2. Permanent plot study: Comprises 34 plots, established mostly between 1926 and 1932, 26 located on

areas treated by different methods of cutting and 8 located following forest fire. Plots contain a total of 1,149 reproduction quadrats examined annually. Plots contain also 4,696 tagged trees observed annually for cone crops and remeasured every 5 years for growth. Eleven of the plots furnish data on special treatment of hemlock. Located in the plots are 102 seed traps; some examined once, some six times a year. Seed storage in the duff is studied by a separate pair of installations to run over 8 years and started in 1927 and 1929. Seed is recovered and germinated annually. A survival study to determine causes of mortality was conducted in 1932 and 1933 by an intensive set-up of small, sowed quadrats located under clear-cut, half-cut and full-timbered conditions and checked by instrumental measurements.

RESULTS OF PAST YEAR: The regular annual examinations of all permanent installations were barely accomplished in 1933 by short cuts and reduced standards of work. With availability of emergency funds for office work, current records will be compiled to date this winter.

PLANS F. Y. 1935: Make annual examinations of reproduction, cone crops, etc., on all plots and half-decade remeasurements of trees on seven plots. Continue survival study on

reduced basis. The major work of the silviculture staff this year will be to prepare a western white pine bulletin and special articles on the cut-over area and survival studies.

ASSIGNMENT: Weidman, Haig and Thompson.

RS-NRM

PROJECT: M-8: Management of ponderosa pine type. (Formerly Mc-101).

SCOPE: To study methods of cutting and regeneration.

STATUS: Three selective logging plots established in 1932 at Greenough, Montana, 35 miles from Missoula. A cooperative undertaking between silviculture and products members of Station staff, the Regional office of Management, and several State and private agencies. Silvicultural participation consisted of helping in the planning and establishment, in taking tree diameters and descriptions, and in marking the silvicultural selection plot. Entire responsibility for periodic remeasurements to rest with silviculture section of staff.

RESULTS OF PAST YEAR: Installation of 20 reproduction quadrats each in 2 plots and 10 quadrats in the other.

PLANS F. Y. 1935: Compilation and write-up of silvicultural features for the selective logging report.

ASSIGNMENT: Weidman.

RS-NRM

PROJECT: Mt-1: Methods of thinning western white pine. (Formerly Mt-102).

SCOPE: To determine suitable methods for securing the best growth and quality production in young stands.

STATUS: A total of 25 plots have been established as follows: At Priest River Branch, 4 in 1914, 4 in 1919, 2 in 1925, 1 in 1926, 7 in 1933. At Deception Creek Branch, 7 in 1933. All plots have been remeasured at scheduled 5-year intervals. Records of 11 plots started previous to 1933 have been compiled to date and inscribed on atlas-size summary sheets.

RESULTS OF PAST YEAR: The 14 plots established in 1933 were made possible by ECW and NIRA funds on stand improvement projects. Records have been coded and sent to Washington for machine compilation.

PLANS F. Y. 1935: Nine plots are due for remeasurement at Priest River. If CCC camps are available in 1935, the establishment of at least 5 plots at Priest River and 8 plots at Deception Creek is planned. Desirable to have some plots in younger stands. Analyze records of older Priest River plots and prepare progress report if opportunity is afforded.

ASSIGNMENT: Weidman.

RS-NRM

PROJECT: Mt-2: Methods of thinning ponderosa pine. (Formerly Mt-101).

SCOPE: To determine suitable methods for securing best growth and quality production in young stands.

STATUS: Nine plots were established in 1933 on administrative site located on the Lolo N. F. 20 miles from Missoula near Frenchtown. The area is covered with a dense, 50-year old, second-growth stand, in which the Experiment Station supervised a small CCC thinning project.

RESULTS OF PAST YEAR: Establishment of the 9 plots was made possible by ECW funds and workers. Records have been coded and sent to Washington for machine compilation.

PLANS F. Y. 1935: No additional plots contemplated.

ASSIGNMENT: Weidman.

RS-NRM

PROJECT: ME-1: Growth and yield in western white pine type. (Formerly ME-102, ME-182, TS-102)

SCOPE: To prepare normal yield tables and to work out application of such tables to natural stands. To study, on permanent sample plots, the growth and development of understocked and fully stocked stands from youth to maturity.

STATUS: Total of 31 permanent and 56 semi-permanent plots, established mostly between 1922 and 1926. Remeasured at 5 and 10-year intervals. One pair of plots will supply information on pruning of butt log. Two plots are devoted to growth in over-mature stands and one to growth in almost pure cedar. Two check plots for thinning serve as additional yield plots. Normal yield table bulletin was published in 1932. Permanent plot records to date being compiled and transferred to atlas summary sheets.

RESULTS OF PAST YEAR: Seven plots remeasured. Records coded and sent to Washington for machine compilation.

PLANS F. Y. 1935: Five plots to be remeasured in spring of 1934.

ASSIGNMENT: Haig.

RS-NRM

PROJECT: ME-2: Growth and yield in larch-fir type. (Formerly ME-141, 161).

SCOPE: 1. To study increment of residual stands after selective cutting and prepare a preliminary yield table for such stands. 2. To study growth and yield of even-aged stands.

STATUS: Thirty temporary plots were taken in 30-year old cuttings near Kalispell in 1932. The project started as a Regional administrative research project with ranger field crew under Experiment Station direction. Compilation of records completed at Station by detailed rangers. The even-aged phase of project consists of one larch and three Douglas fir yield plots; established at the Priest River Branch between 1916 and 1926 and remeasured at 5-year intervals.

RESULTS OF PAST YEAR: No activity.

PLANS F. Y. 1935: A three-man crew to be put in field for 2½ months to complete collection of data in old cuttings in vicinity of Kalispell and elsewhere in western Montana for yield table of residual stands.

ASSIGNMENT: Weidman.

RS-NRM

PROJECT: ME-3. Growth and yield in ponderosa pine type. (Formerly ME-101).

SCOPE: To collect data in even-aged stands for the inter-regional yield tables to be prepared by W. H. Meyer. Remeasurement of permanent and semi-permanent plots to study growth and development of such second-growth stands.

STATUS: Thirty-three temporary plots were taken in western Montana in 1932. About 20 of these are suitable as semi-permanent plots for remeasurement.

RESULTS OF PAST YEAR: Three permanent yield plots were established on the CCC thinning project near Frenchtown, Montana, two of which will furnish information on pruning to height of butt log. Two check plots for thinning will serve as yield plots also. No activity on temporary yield plots.

PLANS F. Y. 1935: A three-man crew to be put in field for 2½ months to complete collection of data in Montana and northern Idaho for inter-regional yield table study. Secure needed temporary plots.

ASSIGN-MENT: Weidman.

RS-NRM February 1, 1934.

PROJECT: Protection Pf-1 (attack) - Fire control planning.

SCOPE: (a) Analysis of 12,056 fire reports for the 13 western Forests in Region 1, 1921-30, and interpretation of the data into conclusions establishing objectives of protection by timber types, and the fire control practices necessary to attain these goals.

(b) Detection studies: Determine for each fuel and weather condition the practices necessary to obtain satisfactory detection time. The following phases are being studied.

1. Maximum permissible size of blind spots.
2. Length of and interval between observations.
3. Effective observation distances.
4. Best methods for finding the most efficient combination of positions.

(c) Initial Attack on Fires: 1. Methods of finding, in correlation with detection stations, the most efficient combination of positions.

2. Determination of satisfactory strength and speed of attack for different fuel-weather conditions.

(d) Reinforcement Attack: Determination, for each fuel and weather condition, the transportation system that will, for any distance away from the man-power base, deliver the number of men needed.

(e) Fire Control Plans: By satisfying detection (b), smokechasing (c), and reinforcement (d) requirements and making compensating adjustments the organization estimated to hold loss to the minimum will be determined. Loss is considered to be the sum of control expenses plus damage. The following three factors will be evaluated:

1. Occurrence or frequency of fires.
2. Damage or valuation of destructible resources.
3. Fuel or expense of fire control.
   i. Rate of fire spread.
   ii. Resistance of fuels to control effort.

(f) Publication: The final step in completing the fire control planning project is to publish a description of the methods and technique developed, together with the supporting data and the accomplishments.

STATUS: (a) Report establishing standards and describing past practices completed in November, 1932. Revised to incorporate suggestions by Watts and Jefferson in December, 1932. Reviewed by Kelley in January, 1933. Not yet reviewed by Stockdale, Munns or the research editor.

(b) Detection studies: Studies of visibility distance using a Bennett-Casella meter were begun in August, 1933, with measurements four times daily by one lookout.

No measurements have as yet been made of the variations in discovery time caused by any of the large

number of influences.

(c) Initial Attack: See (e) below.

(d) Reinforcement Attack: (See (e) below.

(e) Fire Control Plans: Plans will be completed by May 1, 1934, covering 14 million acres within the 11 overburned Forests.

RESULTS: (a) Used by Hornby as basic to work under b, c, d, e, and f. Tables of significant data distributed to all fire Forests in 1932.

(b) to (f) After making a thorough analysis of fire control needs, the geographical locations of points to be manned have been systematically worked out for 14 million acres of 11 Forests. For each station to be occupied the specific structures needed have been determined and from ratings of priority it is possible to select the most important projects to the limit of available funds. Construction projects include not only the structures at a point but also the communication facilities, roads, trails and landing fields required to permit attacking fires within the time limits needed.

Under this distribution of facilities the fire control organizations may be strenghtened by increasing man-power and the number of stations occupied in direct proportion to the increase in fire danger. For each of five degrees of burning severity the locations for de-

tectors, individual smokechasers and crews have been specified and the percentage of area covered under each step-up has been determined. Under this plan the degree of protection given prior to the study can be provided with 20% less men and funds than was provided by the former man-power placement. This does not mean that protection will be satisfactory with a 20% cut for the reason that previous organizations were not strong enough to reduce burned area satisfactorily. The efficiency gained by the plan work exceeds $50,000 per year in addition to the value of training about 100 Forest officers to think and work much more analytically in the future. With the total cost approximating $140,000 for three years of work it is evident that as planning progressed it repaid its expense of one cent per acre.

Hornby has submitted to the Journal an article describing the fuel mapping methods practiced. He is preparing two more articles for early publication. One describes the method used in determining allowable travel times in relation to fuels, severity of burning conditions and strength of attack. The other presents a method of rating the relative fire danger in different parts of a large area, combining the influences, frequency of fires, values at stake, fuel rate of spread and resistance to control.

PLANS F.Y. 1935

It is hoped that the manuscript covering this phase of the project will be returned by the reviewers in time for reconsideration and preparation in final form for publication before July 1.

(b) to (f) In developing methods of planning as well as in the execution of plans the major work of investigation is largely completed except for writing and publication. The making of plans for the 11 overburned Forests will be completed about May 1, 1934, and the written descriptions will be completed by June 1. Thereafter it will require all of Hornby's time to December 1, in addition to work hereafter discussed, to assemble and write up for publication the proposed bulletin.

Detection, Stationary vs. Moving: Due to the very heavy and added load of plan work, caused by necessity to expend NIRA funds most efficiently, it was impossible to carry out in 1933 this contemplated study. A great deal of work remains in determining the seen areas that may be added by routing detectors over specific stations on and near roads. The Office of Operation is assigning C. B. Sutliff, trained two years in plan work under Hornby, to supervise seven men engaged during the 1934 field season in collecting field data. Some of Hornby's time will be required in this study.

Visibility Distance in Region One: It is planned to obtain daily measurements of visibility distance for a period

of several years from three widely separated lookout stations in Region One. The intention is to find out the deviation of different degrees of visibility for application to the necessary corresponding spacings of detectors.

In addition to the one station (Priest River Experiment Station L.O.) that began readings in August 1933, it is intended to establish one on the Flathead Forest and another probably on the Clearwater, each to be a permanent station occupied as long as possible each season. It is proposed to use Bennett-Casella meters and if McArdle's new meter becomes available, continuous simultaneous measurements will be made until definite relationships are determined.

It is intended to determine visibility distances of small smokes (NW Station standard smoke candles) under different readings of the visibility meters and in the neighborhood of the meters. Since Region One's most important visibility distance is in late afternoon with smokes frequently located in deep shadows, measurements will be confined largely to those conditions. By inquiry of the Northwest and California Stations it was learned that with this restriction duplication of investigative effort would not occur, since they are confining their attention largely to smokes in sunshine. The work will be under the super-

vision of Hornby and will require at least one and one-half months of his time divided equally between field and office.

R-NRM February 8, 1934.

PROJECT: Protection Pf-2 (Behavior) - Measuring the Daily Variables of Forest Fire Danger.

SCOPE:

1. Cooperation with the Weather Bureau in obtaining better weather forecasts.
2. Studying the occurrence and characteristics of lightning storms.
3. Determining the effects of each of the weather elements on fuel moisture; developing methods of measuring fuel moisture; correlating fuel moisture with inflammability and fire behavior.

STATUS:

1. Sixteen forest weather stations are supervised or operated by the Experiment Station in cooperation with the Weather Bureau. Over 350 rain-gauge stations report to the Station to permit drawing a regional map of all good rains. About 150 inexpensive wind gauges are being calibrated for installation in 1934.
2. Lightning data collected at 125 lookout stations are coded annually by the Station. One 5-year report was issued in 1931.
3. Measurements of all weather elements and of duff and wood moisture are made twice daily on three sites, clear-cut, half-cut and full timbered at

Priest River. The duff hygrometer and wood cylinder methods have been invented for measuring fuel moisture. Those methods are used at 41 stations in R-1 and at 7 in R-4. The fuel hygrograph has been invented in collaboration with Madison Laboratory. One was tested in 1933. Seven more have been ordered for use in 1934 to study fuel moisture on north vs. south slopes by elevation classes from 2,400 feet up to 5,900. The hygrometer method of measuring soil moisture was tested in 1933 and is to be continued experimentally. The Fire Danger Meter was devised in 1931, tested in 1932 and used daily on all fire forests in 1933.

RESULTS OF PAST YEAR:

1. Accuracy and localization of weather forecasts are being steadily improved.
2. Control of lightning fires is being improved by use of information from this study.
3. Measurements are being substituted for estimates and inaccurate descriptions of degree of danger. Character of the 1933 fire season is rated as 57½% of the worst possible, based on daily measurement of 6 factors of danger at 41 stations on 13 forests. It has not been possible, previous to the development of the Danger Meter, to rate danger on a numerical scale. Statistical analysis of

relations between weather elements and duff and wood moisture is uncovering much new and basically important information.

PLANS F. Y. 1935:

1. Try to persuade the Weather Bureau to continue the position of fire-weather specialist in the Spokane office of the Bureau.
2. Continue the lightning study.
3. Check the field operation of the 41 inflammability stations to insure the best possible accuracy and the maximum local use of these measurements. Complete the photographic description of these stations. Make tests to devise a standard exposure of instruments so that differences between measurements at various stations will not be caused by differences in the exposure of instruments. Try to devise an exposure that will compare with the average of the clear-cut and half-cut exposures at Priest River.

Incorporate into the Fire Danger Meter provisions for increasing or decreasing the danger rating according to the quantity and condition of grass, weeds and similar low cover.

Continue the tests of the hygrometer method of measuring soil moisture.

Select 5 pairs of inflammability stations on North and South slopes, at elevations of approximately 2,500', 4,000' and 5,900' and install a fuel hygrograph at each station. During the first year of this study of fuel moisture and wind by exposure and elevation measurements of temperature, humidity and rain will not be included, due to excessive instrument costs.

Jemison's major responsibility during the year will be the completion of the analysis of data and the preparation of a report on the relation of weather elements to fuel moistures on three sites.

ASSIGNMENT: H. T. Gisborne, Silviculturist, project leader.
C. M. Jemison, Junior Forester, assistant.

RR-MRM February 9, 1934.

PROJECT: Management of Short Grass Ranges.

SCOPE: Determine the correct utilization practice for yearlong cattle ranges in the short grass region, from the standpoint of the requirements of vegetation and soil maintenance, but with full recognition of the economics of livestock production. Stability, balanced use of range and supplemental feeds, reduced livestock production costs and the minimum size of an economic range livestock unit are all phases of this problem of proper land use in the short grass plains which require definite range research data.

STATUS: Sixty cows were started in July 1932, on utilization tests on twelve fenced experimental range pastures aggregating 1,847 acres divided into three intensities of yearlong grazing. Minor changes were made in the case of 4 of these pastures and various improvements, including a cabin and a set of stock scales, were installed the past summer. About 19 miles of fence, 2 sets of corrals and one cabin were constructed in 1932. Forty new quadrats were charted in 1933 and the 17 established in 1932 were recharted. Other special vegetative plots have been established and significant data recorded.

RESULTS OF PAST YEAR:

The cows with ample range retained their average of 53.5# weight lead from the 1932 summer grazing and added 33.3 pounds to it during the 1933 grazing year, as compared to those on overgrazed range. To this must be added a pro rata share of the 28.1 pounds greater average weight of the first calf crop of 1933, or an average of 25.2 pounds for each cow, including the dries. This total of 58.5 pounds for the past grazing year is, at even 4 cents per pound, worth $2.34 more per cow from the pastures that provide ample forage. Adding the 53.5# margin for the partial 1932 season gives a gross of 112 pounds worth at the above rate of $4.48 over the period of approximately 1½ years.

The net penalty of overgrazing is obtained by subtracting the only additional cost--that of a larger range acreage used by cows on normally grazed as compared to overgrazed pastures. This amounts to 7.4 acres per cow. Similar range may be leased at from 5 to 10 cents per acre. Using the 10 cent per acre lease price the net margin in favor of conservative range use is $1.60 per head for 1933 and $1.40 per head for the 5 months' season of 1932.

Perhaps the most significant point of the foregoing is that a serious financial penalty for over-

grazing is suffered before serious deterioration of the overgrazed range is evident. Thus, a financial incentive is provided for conservative range use.

PLANS F. Y. 1935: Continue weight and vegetation records and establish additional plots as needed and develop utilization, standards or guides.

ASSIGNMENT: Leon C. Hurtt and F. H. Kennedy, in cooperation with Montana Agricultural and U.S.R.L. Experiment Stations.

RR-NRM February 10, 1934.

PROJECT: Artificial Range Reseeding.

SCOPE: To find the most promising methods and forage species, costs considered, for reseeding plowed dry lands or overgrazed ranges, and to determine the place that such plants should play in a balanced program of range livestock production and proper land use. Sub-marginal dry farm land mainly in eastern Montana, amounting to between 4 and 5 million acres, that has been plowed and abandoned and is now tax delinquent presents an erosion and watershed menace that demands much data that is not now available.

STATUS: Limited reseeding work from regular Forest Service funds was started at old Fort Keogh in the spring of 1932 and continued in 1933. Under a substantial allotment of Nira funds last fall this reseeding work is being considerably expanded by reseeding certain National Forest special use and burned areas; also on abandoned dry farm land at old Fort Keogh and on privately owned plowed and abandoned dry farmed areas between Missoula and Miles City. Cooperative agreements are required for these private land areas. Limited time for which Nira funds are available dictate

that reseeding on these cooperative privately owned areas be on a demonstration, rather than on a strictly research, basis. The more detailed work will be centered largely at the U.S.R.L. Experiment Station.

RESULTS TO DATE: Crested wheat grass has been the chief species used so far. A field of approximately 6 acres, besides several smaller plots sowed under different conditions of competition and soil, were established at old Ft. Keogh in 1932, but a very poor stand resulted from seeding in the spring of 1933. During last October and November about 30 acres of fall reseeding were done under cooperative agreements on privately owned abandoned land, about 15 acres on the Helena and Custer National Forests and 5 acres at the U.S.R.L. Experiment Station, or a total of about 50 acres. Results of this fall work are not yet available. Crested wheat grass has been favored in this work but 7 other species have also been used.

Limited work thus far has proved that crested wheat grass will grow well on heavy gumbo as well as on strong alkaline soil in the Miles City climate and that it starts growth early in the spring, revives from drought dormancy promptly in summer or fall after a soaking rain, and that it promises to choke

out russian thistles and annual brome grass.

Korean lespedeza, sowed last year at Miles City, produced a very poor stand except on one small plot where it was watered and even that failed to produce seed.

PLANS F. Y. 1935: Spring seeding is to be done adjacent to the fall seeded areas for comparisons and on additional tracts up to possibly 500 acres sowed. Seeding of a substantial acreage in the fall of 1934 is also contemplated.

A field is to be reseeded at old Ft. Keogh and grazed by yearling calves in comparison with an adjacent area of native grama and buffalo grass range to determine the relative range values in actual practice. A nearby field, cultivated until 1934, has been abandoned and fenced to determine the relative rate of revegetation under artificial and natural reseeding.

Some reseeding work may be undertaken on recent burns in the non-commercial timber producing types of the western National Forests.

ASSIGNMENT: Leon C. Hurtt, with the assistance of F. H. Kennedy, and a Junior Range Examiner to be appointed; in cooperation with the Montana and U. S. Range Livestock Experiment Stations and various private land owners.

PROJECT: Forest Survey - Inventory Phase.

Covering the Inland Empire Region of the Pacific Northwest. The Inland Empire is defined as Montana, west of the Continental Divide; Idaho, north of the Salmon River; and the forested counties in northeastern Washington tributary to Spokane. Three counties, Spokane, Pend Oreille and Stevens, have been designated as that part of the Inland Empire in northeastern Washington.

SCOPE: The inventory phase of the Survey consists of:

a. Determination of the area of each type of forest cover and the estimated stand by species.

b. Classification of the present stand according to its accessibility for conversion.

c. Forest cover map.

d. Determination of regrowth conditions on cut-over and burned lands.

e. Classification of the forest area according to ownership and use policy.

f. Classification of forest area according to its forest productivity.

STATUS: There are approximately 25-1/2 million acres of forest land within the above designated region. Fifty-three percent of the above total, or 13-1/2 million acres, is in the National Forests. Inventories of varying degrees of intensiveness have been made of the forest resources within the National Forests. One and one-

half million of the 12 million acres of public and privately owned forest land outside the National Forests have been mapped in place to date. In addition, estimates have been obtained on some 900,000 acres of merchantable timber owned by the state and large private owners. The cruises have been adjusted on approximately 170,000 acres of the above merchantable timber. The office compilation for some 390,000 acres typed in place has been completed.

RESULTS OF PAST YEAR: Progress on the inventory phase of the Survey was very disappointing during the past (1933) field season. A good start was made in April and by early June the field mapping crew had been built up to the six-man maximum possible with the funds allotted. In May the field crew was shifted to an area newly acquired by donations to obtain for immediate use the forest type and stand data necessary to establish blister rust control working units for the location of a number of C.C.C. camps. The Region detailed two men for a month to work with the Survey crew. Shortly before July first the uncertainty of funds for the work began to cut down the crew. The heavy cut in regular appropriations made it necessary to lay off all temporary employees before the end of July. When Nira funds became available it was impossible to re-employ immediately the experienced men that had been released. A crew of four men were started in the field

shortly after October first and worked until weather and road conditions made the cost of the work prohibitive.

During this limited field season 1,110,000 acres were mapped in place. The field mappers averaged 49,000 acres per man per month. In addition to the field mapping, estimates and other forest information were obtained on 500,000 acres of merchantable timber owned by the state and private companies in Idaho and Washington.

Late in July Glacier National Park was given permission to put on a 10-man timber type mapping crew using E.C.W. funds. One of the Survey's field mappers, released because of lack of funds, was placed in direct charge of the type mapping. The work done followed closely the plan set-up for the Inland Empire Forest Survey project. Inspection of the work was made by Bradner, cooperating with the Park project leader.

By cooperative planning the pre-eradication survey crews of the Blister Rust control office obtained additional information on type boundaries, type, age classes, and stocking of value to the Survey on 1,200,000 acres of forest land in northern Idaho, western Montana and northeastern Washington.

The inventory phase of the Survey has not advanced to a place where it is possible to give anyoutstanding results.

PLANS F. Y. 1935

Except for the payment of salaries and expenses of the two permanent members of the Survey organization, during the last half of the F. Y. 1934 all of the work contemplated will be financed with Nira funds. In order to obtain the most efficient use of the funds available it is necessary to concentrate the work within the limits of a rather short field season. This means that with the exception of the amount necessary to take care of the permanent staff during the F. Y. 1935, the bulk of the money will be spent between April and October, 1934. Work plans for the last half of F. Y. 1934 and the F. Y. 1935 contemplate the following:

FIELD MAPPING

State	Outside N. F.	Inside National Forests Bringing Forest Data to Survey Standards	
		Forests to be Completed	No. Acres
Idaho	1,560,000	4	2,800,000
Mont.	1,430,000	3	2,970,000
Wash.	880,000	1 (Part)	265,000
Region:	3,870,000	7	6,035,000

Collection Cruise Data: 960,000 acres merchantable timber.

Adjustment Cruising: 800 forties - 10% cruise.

Office Compilation: 14 man months.

It is estimated that with the funds now available the Inventory phase of the Survey will be in the following status by the end of F. Y. 1935:

FIELD MAPPING

State	Outside National Forest	Inside National Forest
Idaho	53% completed	75% completed
Montana	40% "	40% "
Wash.	48% "	100% "
Region	47% "	55% "

Collection Cruise Data: 100% completed.

Adjustment Cruising: 33% completed.

Office Compilation: 10% completed.

ASSIGNMENT: M. Bradner, Regional Director, and G. M. DeJarnette.

RP-NRM February 10, 1934.

PROJECT: Forest Survey - Requirements.

SCOPE: To determine the current need for forest products based on present consumption. To determine the trends in the uses of forest products and the underlying causes for such trends. To determine the major opportunities for expansion in outlets for products of our forest lands.

STATUS: Collection of data on volume and type of construction in cities selected as sample plots has been completed. Seven of the principal cities of the region, including Missoula, Butte, Bozeman, Livingston and Great Falls, Montana; Lewiston, Idaho and Spokane, Washington, have been covered. In five of these cities detailed card records for each new building or repair permit issued in 1929 were made. At Spokane and Butte data needed to supplement published records were obtained. In most of the cities mentioned, summaries showing total volume of construction and number of living units provided annually, 1921 to 1930 inclusive; vacancy records and timber requirements of city governments were collected. New data on the use of forest products by some Electric and Telephone Utilities are now available. Conversion factors for use in determining the relation between cubic volume of different classes of buildings and the lumber required in their construction can be worked up from bills of material now at hand.

RESULTS OF PAST YEAR: Cards bearing detailed information from the building permit records of five cities were made for 452 dwellings, 18 apartment houses, 699 buildings of non-residential classification and 738 repair jobs. Bills of material from 16 dwellings and apartments, 8 commercial buildings, 3 semi-public buildings and 4 institutions were obtained. Data on total mileage of lines and annual timber requirements of the Montana Power Company, the Montana-Dakota Company and the Mountain States Telephone and Telegraph Company in Montana were collected. Building permit records collected were tabulated by a C.W.A. clerk in December, 1933. Time spent on the Requirements phase of the Forest Survey in 1933 amounted to 4½ months by Whitney and 1/2 month for one clerk.

PLANS F. Y. 1935: Collect at Missoula additional data on conversion factors for sash, doors and other mill work. Complete summarization and analysis of urban building construction. Collect from mine operators and public utilities, data which can be obtained to the best advantage locally. Take from Federal Civil Works Administration Farm Housing Survey schedules data of value in our Survey of Rural Timber Requirements. If time and funds are available, obtain information on timber requirements of farm and rural communities by sampling in accordance with Mr. Hallauer's working plan. It is

estimated that during the F. Y. 1935 Whitney can spend approximately half-time on the Requirements project.

ASSIGN-MENT: M. Bradner, Regional Director, and C. N. Whitney.

RP-NRM

PROJECT: Logging and Milling.

SCOPE: This project provides information on two important phases of logging and milling. They are:

1. Selective Logging - which has three objectives:
   a. To determine production costs and market values for logs, trees, lumber and other forest products produced from each commercial type in the Region. Final results to show from a regional standpoint, or for an individual holding, cutting limits (by tree d.b.h. and area) and utilization standards necessary to provide a reasonable profit for the operator when practicing varying degrees of silviculture.
   b. To make available to outside agencies, information secured incidental to the main project, such as overrun data, efficiency comparisons of various types of logging and milling equipment, etc.
   c. To make available to outside agencies, data fundamentally useful in the promotion of industrial forestry.
2. Logging output studies designed to measure the output of new logging equipment and new logging methods.

STATUS: 1. Selective logging studies have been undertaken in the western white pine type, the ponderosa pine type and the larch-Douglas fir type. Studies and their status are listed below by timber types.

Study	Field Work	Office Work	Results Made Available
a. Ponderosa pine type.			
Heron Lumber Co.	Complete	Complete	Yes
Harper Lumber Co.	"	"	"
J. Neils Lumber Co.	"	"	"
A.C.M. Relogging	"	"	"
A.C.M. 1932	"	3/4 "	No
b. Western white pine type.			
Region wide 1925 mill scale	Complete	Complete	Yes
Ohio Match Co.	"	1/2 "	No
c. Larch-Douglas fir type.			
Kinshella Tie Mills	"	3/4 "	Partly

2. Logging output studies inactive during year.

RESULTS OF PAST YEAR: 1. Selective Logging. Data from four ponderosa pine selective logging studies were combined and prepared for card-punching by the computing section of the Madison Laboratory. Cards for the A.C.M. study were also punched, sorted and summarized at the Laboratory. These data have been analyzed and a manuscript for publication of results is now being prepared. Information is now available, using lumber code costs and selling values, on the minimum

profitable sized ponderosa pine trees for the following cutting practices: (1) clean cutting all species, (2) clean cutting only pine, (3) economic selection of trees, (4) Forest Service Selection.

PLANS F. Y. 1935:

1. a. Completion of manuscript for A.C.M. selective logging study.

   b. Analysis of all ponderosa pine selective logging data from a regional standpoint and preparation of departmental bulletin.

   c. Special work incidental to article X of Lumber Code.

ASSIGNMENT: Anderson and Bradner.

RP-NRM February 1, 1934.

PROJECT: Statistics on Forest Products. (Includes RE-Statistics-Annual Lumber Census, Price and Lumbering Costs).

SCOPE: The scope of this project is three-fold:

Activity 1. A canvass of all the sawmills and producers of miscellaneous timber products to obtain the production of lumber, lath, shingles and miscellaneous timber products.

Activity 2. Collection of lumber and timber price statistics for northern Idaho, eastern Washington and western Montana, in sufficient volume to indicate periodic trends in the selling price of lumber (wholesale and retail) stumpage, logs, cedar products and ties.

Activity 3. Collection of detailed logging and manufacturing costs from the larger lumber companies in northern Idaho, eastern Washington and western Montana, by personal contact.

STATUS: Activity 1. This work is handled each year for the states of Idaho and Montana in cooperation with the Bureau of Census. On the average 800 concerns are canvassed, some of which require personal solicitation. It is planned to continue this cooperative project indefinitely.

Activity 2. Annual wholesale lumber prices are now available dating back to 1912. Retail prices on lumber are available dating back to 1920. Wholesale prices on logs, ties and cedar products are also available back to 1920.

Activity 3. Detailed lumber production costs are now available back to 1916.

RESULTS OF PAST YEAR: Collected and compiled statistics on all the activities outlined above last year as in the past.

PLANS F. Y. 1933: Continuation of all activities in project.

ASSIGNMENT: Whitney to Activity 1; Anderson and Hinton to Activity 2: Bradner and Neff (Regional Logging Engineer) to Activity 3.

RP-NRM

February 10, 1934.

PROJECT: Wood Preservation.

SCOPE: To determine the durability of treated and untreated local woods in actual service and the efficiency of various preservatives, including results of treatments by different processes. This work is done in cooperation with the Forest Products Laboratory.

STATUS: The project now includes 22 installations distributed widely throughout the region. More than 20,000 test timbers consisting of full sized railway ties, telephone and electrification poles, pole stubs, fence posts and mining timbers are included. Data on 4 of these installations are obtained from inspections made by Forest Supervisors. In addition to the detailed service records obtained for poles specifically designated as experimental timbers, the Montana Power Company and the C.M.St.P. & P. Railroad Company furnish stubbing and replacement records on approximately 33,000 treated and untreated power line and electrification poles.

RESULTS OF PAST YEAR: Inspections of two test tracks, three telephone lines and one test fence were made as scheduled for the year. Average life figures for arsenic-treated stubs in the Hebgen-West Yellowstone telephone line were com-

puted and this test closed. Instead of making the inspection of the National Bison Range Fence, as had been planned, replacement data furnished by the superintendent of the Range were used in bringing the service records of this test up to date. An inspection of the Bozeman-Flathead Telephone line undertaken on October 21, 1935, could not be completed because of snow. No new tests were started during the year.

The paper by R. M. Wirka, entitled "Service Records of Treated and Untreated Poles", published in "Electric World" of July 22, 1933, contained summaries contributed by this station for twelve pole lines on which Whitney collected the data used.

PLANS F. Y. 1936: Make inspections and prepare reports on each of the following installations:

Project L-50 - Northern Pacific Test Track Ties, Thompson Falls, Montana.

Project L-214- Northern Pacific Test Track Ties, Missoula, Montana.

Project L-214- Bozeman-Flathead Telephone Line, arsenic-treated and creosoted stubs, Gallatin Forest, Montana.

Project L-214- Choteau-Mar Mountain Telephone Line, creosoted lodgepole pine stubs, Lewis & Clark Forest, Montana.

Project L-214- Sunnyside Ranger Station Fence, arsenic-treated posts, Deerlodge Forest, Montana.

Project L-214- Livingston-Main Boulder Telephone Line, arsenic-treated stubs and poles, Absaroka Forest, Montana.

Project L-214- Gates of Mountains Transportation Co., arsenic-treated poles, Helena to Hilgers' Landing, Montana.

Project L-263- Experimental Fence Posts, Miles City, Montana, posts treated by steeping; creosote-petroleum mixtures and arsenic, in cooperation with U. S. Range Livestock Experiment Station.

If time permits, start in connection with some of the improvement projects developing in this region, one or two experiments on the treatment of fence posts with petroleum oil containing tetrachlorophenol or orthophenylphenol. Information from Mr. George M. Hunt of the Forest Products Laboratory indicates that preservatives of this kind need extensive field studies. According to Mr. Hunt's proposal, if a start can be made on such studies, the Laboratory will assist in securing the necessary toxics.

ASSIGNMENT: Whitney.

RP-NRM

PROJECT: Species Utilization for Western Larch, White Fir, and Lodgepole Pine.

SCOPE: a. To prepare or assist in preparing bulletins to furnish detailed information on the properties and characteristics of the wood of several of the Region's little-used species (western larch, white fir and lodgepole), which will assist consumers in determining the suitability of the species for specific uses. Generally it is intended to promote the good utilization of such species, thereby increasing the economic value of this source of our present timber supply.

STATUS: a. Western Larch - Bulletin #285 published 1932.

b. White Fir:

c. Lodgepole Pine:

All available data has been assembled but preparation for publication of bulletin has been deferred pending completion of work on other projects of more urgent nature. Present economic conditions in the lumber and timber products industries have

tended to place the widespread utilization and sale of lodgepole pine further into the future. Thus the need for information on utilization of this species has been minimized.

RESULTS OF PAST YEAR: No work done.

PLANS F. Y. 1935: No work contemplated, but the project will be carried on the active list.

ASSIGNMENT: White Fir Bulletin - Bradner.

Lodgepole Pine Bulletin - Whitney.

RP-NRM

PROJECT: Woods and Mill Utilization.

SCOPE: This project will furnish information from time to time pertaining to utilization in the sawmill and the woods, with special reference to the following:

a. Overrun data and efficiency comparisons of logging and milling equipment.

b. Waste investigations designed to inventory and eliminate wood waste in lumbering.

c. Depreciation studies designed to measure volume and value losses caused by agencies such as fire, fungus stain, insects and physical injury during the process of manufacture.

STATUS: a. The results of overrun and sawmill efficiency studies have been presented to the lumber industry of the Inland Empire.

b. Residual wood after logging has been inventoried in the western white pine, ponderosa pine, larch-Douglas fir and lodgepole pine types. Breakage loss in felling timber in the western white pine, ponderosa pine and larch-Douglas fir types has been studied and results prepared for circulation to loggers and lumbermen.

c. The results of comprehensive studies of fire dam-

age, depreciation in river-driven white pine logs and depreciation in white pine logs transported over gravity chutes, have been published and distributed to the northwestern lumber industry.

RESULTS OF PAST YEAR:

a. No current work.

b. No current work.

c. No current work.

PLANS F. Y. 1935: No work planned.

ASSIGNMENT: Anderson and Bradner.

Northern Rocky Mountain Forest and Range Experiment Station
Missoula, Montana